This lava did not by any means come altogether from Mount Taylor itself, but from many vents scattered around its flanks, or situated miles away from it. These outlying vents are sufficiently preserved in many cases to admit of their complete identification, and they are very numerous. But one of the most charming and striking features consists in the numerous "necks" or "chimneys" which are left standing in the valley-plains beyond the farthest verge of the lava-capped mesas. Some of these are splendid objects. Newberry has depicted similar forms in the valley of the San Juan—a hundred miles or more to the north-west of here—in his admirable account of the observations made in his journey with Capt. Macomb's expedition. But these are even larger and finer, one being nearly two thousand feet high. What perfect testimony this is to the enormous erosion of the country! A child can read and comprehend it.

In the wide valley-plains which lie between the mesas are fresher fields of lava. Some look as if they could hardly be a century old; but my experience in the Hawaiian Islands has taught me that, in a dry country, a basalt-stream can preserve its freshness for many centuries. Still, it is clear enough that these eruptions occurred after hundreds, even thousands, of square miles of strata, overflowed by the older basalts, had been eroded away.

A striking fact in connection with these young basalts is the entire absence of all distinguishable traces of the vents from which they came. A few miles from here, in a broad valley, lies a basalt-field black as Erebus, and the whole circuit of it as accessible as a sheet of paper on a table, or a rug on the floor. There is no cone, no trace of fragmental ejecta, not a single feature in it to indicate the *locus* of eruption, except, however, the fact that the whole field, and the valley in which it lies, has a gentle declivity to the south-east, say forty feet per mile or so: and as the sheet follows the modern slope of the valley, it may be inferred that the vent is situated near the north-west end. There are many other fields of fresh lava, of which the above is sufficiently descriptive. One stream is nearly sixty miles long! Some of them, however, indicate unmistakably their sources in small depressed cones of very flat profiles. Great deluges of basalt have issued from them, flowing away for many miles, and spreading out five or six miles wide.

No fragmental ejecta (scoria, lapilli, &c.) have been found in connection with these young eruptions. But on Mount Taylor are numerous parasitic cinder-cones, of small or moderate dimensions, formed during the period of the eruption of the older basalts. The quantity of this fragmental material, however, is relatively very small.

The appearance of the young basalts is much like the rougher lava of Mauna Loa, called "aa" in the Hawaiian Islands. This is the typical *malpais* of this region. All the lava thus far seen is apparently basalt, though some of the older may prove to be andesitic when critically examined. There is little variety in it. It now appears that, all along the western, southern, and south-eastern rim of the Plateau Country is a marginal belt characterised by basaltic eruptions. I have identified two ages of eruption, both here and in South-West Utah. In the latter region I have associated these two periods of eruption with two periods of general upheaval of the plateaux. Whether the same will prove to be so here remains to be seen.

But it is getting dark, and I must close. We go to bed and get up with the chickens in this country.

C. E. DUTTON

NOTES

A MEETING of members of the University and others, to promote the objects of the Marine Biological Association, will be held at Cambridge on Saturday next, the 29th inst., in the Lecture-Room of Comparative Anatomy, the use of which for this purpose was granted to Prof. Newton by grace of the Senate on Thursday last. The Vice-Chancellor of the University (Dr. Ferrers, F.R.S., Master of Gonville and Caius College) has kindly undertaken to preside; and Prof. Moseley (the Chairman of the Council of the Association), Prof. Lankester (its Secretary), and Prof. Bell, of the British Museum and King's College, London, are expected to attend and set forth the aims and needs of their deserving body. The chair will be taken at three o'clock in the afternoon, and the proceedings (the details of which are being arranged by Mr. J. W. Clark, Superintendent of the Museum of Zoology and Comparative Anatomy, and Mr. Sedgwick, University Lecturer in Animal Morphology) are likely to be full of interest. The same evening the anniversary dinner of the Cambridge Philosophical Society will be given in the hall of Peterhouse, on the special invitation of the Master and Fellows of that ancient college, the newly-elected President of the Society, Prof. Foster, Sec. R.S., in the chair.

THE German Government has granted another sum of 7500*l.* for the scientific investigation of Central Africa, and 1900*l.* for the working out of the materials collected by German Polar expeditions.

THERE seems to be no end to the works of the highest value issued from the American *Nautical Almanac* Office. This week we have received a paper on "The Motion of Hyperion—a New Case in Celestial Mechanics," by Prof. Simon Newcomb; and another on "Lunar Inequalities due to the Ellipticity of the Earth," by Mr. G. W. Hill.

AT the first meeting of the new session of the Society of Arts held on November 19, Sir Frederick Abel made some feeling and pregnant remarks on the loss that not only the Society of Arts, but the whole scientific world, had sustained by the sudden and unexpected death of Sir William Siemens. In the course of his address Sir Frederick Abel said:—"It will be in the recollection of many whom I am addressing that, while Sir William Siemens was an ardent and successful labourer in the advancement of electric lighting, he also maintained the view that gas would continue to hold its own as the poor man's friend. The name of Siemens is associated with the origination of a great advance in the application of gas to the brilliant illumination of open spaces; but it must also be conceded that many streets and public places in London and the provinces bear evidence that even such simple modifications in the arrangement of old forms of gas-burners as have been introduced by Sugg and others have restored to gas some of its original prestige, and that, especially in towns where fogs are periodically prevalent, gas is now by no means wholly eclipsed by electricity as an open-air illuminant."

LAST week we announced the death of Dr. Wright of Cheltenham; to-day we have to make known that another of the lights of English geology has passed away. Mr. R. A. Godwin-Austen died at his residence, Shalford House, Guildford, on the morning of the 25th inst., after a long, but happily not a painful illness. He has for so many years lived retired in his country home that the younger generation of geologists has hardly known him personally. But his papers are classical in the literature of English geology, and long ago marked him out as one of the most philosophical of all the geological writers of this country.

MR. JAMES BUCKMAN, formerly one of the Professors at the Royal Agricultural College, Cirencester, and author of a number of geological papers, died at Bradford Abbas, Dorset, on the 23rd inst.

THE death is announced of Herr August Wilhelm Thienemann, the President of the German Society for the Protection of Birds, well-known in ornithological circles by his researches

and works. He died at Langenberg on the 5th inst., aged fifty-four years.

We regret to announce the death, at Paris, of M. Lartigue, aged fifty-four, a French electrician well known for his system of railway-signalling, which is largely in use on the French lines, and who had latterly held the post of General Director of the French Telephonic Company.

We regret to learn of the death, at the early age of thirty-four, of M. Henninger, one of the editors of *Science et Nature*. After a brilliant career as a medical student, he was appointed assistant to M. Wurtz in the chair of medical chemistry, as well as professor in l'École municipale de Chimie. He was the author of numerous articles in periodicals and encyclopædias, chiefly on chemistry.

The permanent Committee appointed by the International Ornithological Congress at Vienna for the purpose, among other tasks, of erecting ornithological stations of observation all over the globe, has addressed the Imperial Academy of Sciences in Vienna with the request that, so far as its sphere of action extends, it would seek out and appoint men, able and willing to undertake that office, to make regular observations, each within his own particular district, respecting the birds he finds there, their flight, incubation, mode of life, &c., and report them yearly (in the first quarter of the calendar year) to the Secretary of the Committee. The observations so collected will appear, each contribution being under the name and responsibility of the contributor, and will be scientifically digested and embodied by eminent experts. It is hoped that by these means many points hitherto dark in our knowledge of birds will be cleared up, and science generally be extended and enriched.

Admiral von Schleinitz has resigned the presidency of the Berlin Gesellschaft für Erdkunde, and has been replaced by Dr. W. Reiss. At the last meeting of this Society it was stated that there are now four Polar expeditions in preparation, of which one will start for the Antarctic regions. The African traveller, Dr. Aurel Schulz, has started on a journey across Africa from east to west, by way of the Zambesi River and the Victoria Falls. Lieut. Schulz, the leader of the German African expedition, reports from Cameroon that the joy of the German colonists there is most intense in consequence of recent political events.

The speeches delivered at the sittings of the Universal Prime Meridian Congress at Washington will be published *in extenso* in French, having been translated under the superintendence of M. Janssen, who was specially appointed by the Congress for that task.

The collections made by the Polar traveller, Capt. Jacobsen, by order of the Berlin Museum, on his American tour, are now on view at the Royal Ethnographical Museum at Berlin. That part of the collections which was obtained from Alaska territory, consists of some 4000 objects, collected among various Esquimaux tribes and among the Ingalik Indians living on the Yukon River. Most of the objects in question closely resemble those dating from the Stone Age, consisting principally of stone, bone, horn, shell, or wood.

The expedition of the German travellers, Dr. Clauss and Herr von den Steinen, who undertook to investigate the tributaries on the upper right bank of the Amazon and Xingu Rivers, starting from Paraguay and Cuyaba, have successfully accomplished this task, and safely arrived at Para at the end of October. The Brazilian Government, and especially Senhor Batovi, the Prefect of the province of Matto Grosso, have supported this scientific undertaking in a praiseworthy manner.

The Commission of the Centennial Exhibition for 1889 have already held several meetings with the object of determining upon a site for the Exhibition. As many as four places are competing for this honour, exclusive of the Bois de Boulogne, which was mentioned in connection with this matter some months ago.

The excellent "Monthly Reference-Lists," which are printed by Mr. W. E. Foster of the Providence Public Library, should be watched, says *Science*, by scientific men as well as by literary readers. The August number (vol. iv. No. 8) contains a handy index to articles on earthquakes—theories and observations—which was suggested by the shock of August 10, 1884. In judging of the list of memoirs and articles which are cited, the reader should remember that it is prepared for popular reading, and not as an index for the seismologist, nor even for the physicist. The second part of the same number is devoted to the early English explorations of America.

Telephonic service between Brussels and Antwerp was opened on October 20, the wires being used both for telegraphing and telephoning. The Belgian Government intends establishing telephonic connection between Brussels and Liége, Verviers, Mons, Ghent, Charleroi, and Louvain.

Among the awards given by the jurors at the National Italian Exhibition we notice a gold medal granted to Signor Ragona, Director of the Modena Observatory, for a complete set of astronomical, meteorological, and magnetical instruments designed by him and executed under his personal supervision.

In a recent number of the *Revue Scientifique* General Faidherbe draws the boundaries of the large section in the north-west of Africa in part already fallen, in part about to fall, under French control. In the beginning of April this year the French flag was floating from the fort of Bammakoo on the banks of the Niger, and on September 11 a French steamer had made a run down that river from Bammakoo to Koulikoro, bound for Timbuctoo, 300 miles lower down. Altogether, the French have at present the command of the Niger from Bourré to Boussa, some 700 leagues of water-course. From the North of Africa, again, a French railway runs from Arzen to Mécheria, and in a few years more will be continued to Imsalah. But Imsalah is already connected with Timbuctoo by the caravan routes which, under French protection, must become much more important. From Porto Novo on the Gulf of Guinea, moreover, the French cannot but push to Boussa on the Niger, and so complete their commercial route from the Mediterranean to the Gulf of Guinea.

We have received the Catalogue of the Natural History Collections of the Albany Museum, Grahamstown, Cape of Good Hope, and have much pleasure in observing how considerable the collection already is in specimens both native and foreign, especially birds. For the rest we can only join heartily in the hope expressed by the zealous curator in the preface, that the present inventory of natural history treasures in the young colony will stimulate able friends, at once of the colony and of natural science, to add to the stock and so promote the benign study of Nature in a part of the world not without its share of political troubles. We expect that the promised list of botanical specimens in the herbarium will do justice to the botany, at least, of the South of Africa.

On the eastern coast of Schleswig the experiments to establish oyster-beds are being actively pursued, under the direction of Prof. Möbius, who is an authority on the subject. Quantities of young American and Canadian oysters have been brought over, and are being "sown out" during favourable weather. The experiments made last year have, so far, not been attended with satisfactory results.

The organisation of the Pneumatic Postal Service will be completed on December 15 next for the whole of Paris. This great work, costing more than a million francs and involving over 60,000 metres' length of pipes, was inaugurated by M. de

Couchy, who, seventeen years ago, under the Empire, was Director of the French Telegraphs. The charge for carrying a letter to any place within the fortifications has been fixed at 3*d*. The two extreme points in the service are about 11,000 metres apart, and the time required for the delivery of a letter to the remotest place in the most unfavourable circumstances, and including its conveyance from the nearest station, will be within one hour.

THE Scientific Exhibition at Paris, always held on the occasion of the grand *soirée* given by Admiral Mouchez, Director of the Paris Observatory, will this year be under the management of the French Electrical Society, and its exhibits will therefore be confined to objects relating to that branch of science.

PROF. MELL, Director of the Alabama Weather Service, announces, in *Science*, that through the liberality of the Chief Signal Officer, and of several railways, daily weather-signals, predicting changes of weather and temperature, will be displayed at over one hundred telegraph-stations in that State. The predictions will be received by the Director at an early hour every morning from the Signal Office in Washington, and then promptly distributed along the railways. By paying for the cost of the signal-flags (about six dollars), any town or telegraph-station will receive free telegraphic warning of the daily weather changes. Only about five minutes are required to set the flags. A similar system has been for some time in operation in Ohio and in part of Pennsylvania, and it will doubtless have further extension.

THE Commander-in-Chief of the French army in Tonquin has given orders to have a meteorological observatory erected in Haiphong, the chief port in the delta of the Red River, to serve as a basis for a network of meteorological stations with which it is intended to cover eventually the whole of Annam and Tonquin, and which will be in telegraphic communication with the observatory in Hong Kong.

THE series of illustrations of the methods and stages of instruction in handicraft and technical training contributed by the Austrian Government to the Health Exhibition is stated to have been purchased by the Japanese Government from the Technological Museum at Vienna. The Japanese authorities have also made numerous exchanges with the representatives of other countries exhibiting at South Kensington.

THE additions to the Zoological Society's Gardens during the past week include a Common Seal (*Phoca vitulina*) from British Seas, presented by Mr. James Wyat; two Barred Doves (*Geopelia striata*), three Eastern Turtle Doves (*Turtur meena*) from Java, presented by Mr. Emil Berg; a Green Monkey (*Cercopithecus callitrichus* ♂) from West Africa, deposited; a Red-throated Amazon (*Chrysotis collaria*) from Jamaica, a Red-tailed Amazon (*Chrysotis erythrura*) from Brazil, three Blue Snow Geese (*Chen cærulescens*) from Alaska, purchased; a Bernier's Ibis (*Ibis bernieri*) from Madagascar, received in exchange.

OUR ASTRONOMICAL COLUMN

THE ECLIPSE OF THUCYDIDES, B.C. 431, AUGUST 3.—There has been much discussion from time to time with reference to the solar eclipse recorded by Thucydides in the first year of the Peloponnesian war, and long identified as that which occurred on August 3, B.C. 431. We are told, "the sun was eclipsed after midday, and having assumed a crescent form, some of the stars having also appeared, it again became full-orbed." This eclipse was not total, as has been frequently stated, but narrowly annular. Dr. Hartwig in 1859 calculated the circumstances according to the solar and lunar tables of Hansen, and his results were published, with those applying to other eclipses mentioned by Thucydides, in No. 1203 of *Astronomische Nachrichten*. The greatest phase, by his calculations, falls at 5h. 9m. mean time at Athens, and the magnitude of the eclipse is 0·75, rather small it will be considered, for stars to have been brought into view. But, when all the conditions of the case are borne in mind, it would appear quite possible, to speak within bounds, that Hansen's longitude of the moon may require at that epoch a correction which would suffice, with the rapid descent of the central line in latitude, to cause a great eclipse at Athens, leaving the sun of crescent form, as Thucydides reports, but with the crescent very narrow. In such a climate bright planets and stars might well have been discerned. Venus was westward at an altitude of some 35°, Mars would be near the western horizon, Jupiter had set, while Saturn was near the meridian at an altitude of something like 45°. Of the stars, Spica, Arcturus, Antares, and Vega were in favourable positions for observation.

Sir George Airy informed the writer of these lines some years since that, on the occasion of the partial eclipse of September 7, 1820, he "saw one or two stars" at Cambridge. On calculating the circumstances of the eclipse for that place, it appears the magnitude was 0·88. This is an interesting case in point.

WOLF'S COMET.—A few week's since it was remarked in this column that, according to the first elliptical orbit calculated by Prof. Krueger, this comet would approach very near to the orbit of Jupiter in about 209° heliocentric longitude, and great perturbation was possible early in the year 1875, so that the comet might not have been moving long in its present track. On this subject Prof. Krueger, who has recalculated the elements of the comet's orbit from a much wider extent of observation, expresses himself as follows in No. 2629 of the *Astronomische Nachrichten*:—"In Nr. 782 der NATURE (1884, October 23) ist hierauf bereits aufmerksam gemacht worden; ich hielt indessen damals die ersten Elemente für viel ungenauer, als sie wirklich waren, und glaubte, dass Erörterungen dieser Art noch etwas aufzuschieben seien. Die nachfolgende Rechnung bestätigt indessen die in der NATURE ausgesprochene Vermuthung in überraschender Weise." In fact, Prof. Krueger finds by his new orbit that on May 28, 1875, the comet's distance from Jupiter was less than 0·1 of the earth's mean distance from the sun, and hence it is probable that before the spring of this year the comet may have been describing a very different orbit to that in which it now moves. This, as was before remarked, will form an interesting subject of investigation, when definitive elements have been deduced from a combination of all the observations of the present appearance.

In Prof. Krueger's last orbit, founded on observations to November 7, the period of revolution is 2466·06 days, according to which the comet would have been in perihelion about February 16, 1878, in R.A. 23h. 58m., Decl. + 2°, distant from the earth 2·32, and under such circumstances not likely to have been seen. We subjoin other elements of the orbit:—

Semi-axis major ...	3·5722	Perihelion distance ...	1·5719
,, minor ...	2·9596	Aphelion ,, ..	5·5725
Semi-parameter ...	2·4521	Excentricity	0·559966

MINIMA OF ALGOL.—The following are approximate geocentric Greenwich times of minima of Algol, calculated from elements upon which the later observations of Schmidt have been brought to bear:—

	h. m.		h. m.		h. m.
Nov. 27 ...	13 24	Dec. 23 ...	8 45	Jan. 26 ..	18 35
30 ...	10 13	26 ...	5 34	29 ...	15 24
Dec. 3 ...	7 2	Jan. 6 ...	16 51	Feb. 1 ...	12 14
14 ...	18 18	9 ...	13 40	4 ...	9 3
17 ...	15 7	12 ...	10 29	7 ...	5 52
20 ...	11 56	15 ...	10 18		

THE WAVE THEORY OF LIGHT[1]

THE subject upon which I am to speak to you this evening is happily for me not new in Philadelphia. The beautiful lectures on light which were given several years ago by President Morton, of the Stevens' Institute, and the succession of lectures on the same subject so admirably illustrated by Prof. Tyndall, which many now present have heard, have fully prepared you for anything I can tell you this evening in respect to the wave theory of light.

It is indeed my humble part to bring before you some mathematical and dynamical details of this great theory. I cannot have the pleasure of illustrating them to you by anything compar-

[1] A Lecture delivered at the Academy of Music, Philadelphia, under the auspices of the Franklin Institute, September 29, 1884, by Sir William Thomson, F.R.S., LL.D.